



April 2022

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Recommended Citation

Chang, Tao-Wei; Luk, Hoi-Shing; Tai, Wen-Ken; Chou, Chih-Chen; and Kao, Chia-Tze (2022) "Strategies of Non-extraction Treatment for Class III Malocclusion," *Taiwanese Journal of Orthodontics*: Vol. 34: Iss. 2, Article 3.

DOI: 10.38209/2708-2636.1122

Available at: <https://www.tjo.org.tw/tjo/vol34/iss2/3>

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Abstract

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Keywords

Non-extraction; Mini-screw; Temporary anchorage device (TAD); Distalization; Interproximal reduction

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CASE REPORT

Strategies of Non-extraction Treatment for Class III Malocclusion

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ABSTRACT

The decision of whether to have an extraction or non-extraction treatment plan is a controversial issue for an orthodontist. Many orthodontic techniques can help to resolve the crowding dentition by using the non-extraction treatment plan. This case report describes the correction of Class III molar malocclusion with the application of two mini-screws. The line of action of the force from the temporary anchorage devices pass through the center of resistance in the mandible, therefore the movement of the lower arch can be controlled without lingual tipping or intrusion of the mandibular incisors. At the end of the treatment, Class I molar and canine relationships were achieved with satisfactory outcome. *Taiwanese Journal of Orthodontics* 2022;34(2):90–98

Keywords: Non-extraction; Mini-screw; Temporary anchorage device (TAD); Distalization; Interproximal reduction

INTRODUCTION

Edward H. Angle was regarded as the ‘Father of Modern Orthodontics’. He believed that the extraction of teeth was necessary to solve orthodontic treatment problems.¹ Since then, extraction or non-extraction therapy had always been a controversial issue. According to Dr. Proffit's extraction guidelines, extraction or non-extraction options are possible when arch length discrepancy is between 5 and 9 mm. He emphasized that the key criterion is the facial convexity of the patient.² In recent years, the Temporary anchorage device (TAD) application has become more common in its use for maximum anchorage in non-extraction cases. In this case report, we will be discussing the non-extraction treatment of Angle Class III malocclusion by using the TAD appliance.

CASE REPORT

A 25-year-old female came to the clinic with chief complaint of messy lower anterior teeth. The patient denied any systemic disease. She had no trauma history and there were no signs and symptoms of temporomandibular disorder. Her past dental history had been routine care with 46 root canal treatment.

The patient's extraoral examination showed a straight to concave profile with a long face and deep nasolabial folds (Figure 1). She had a prognathic mandible with mild facial asymmetry. The patient's chin deviated to her right side and the upper dental midline was shifted 2 mm to the right.

The intraoral examination showed that she had an overbite of 3 mm and an overjet of 2 mm. The relationship of the molars was an Angle Class III malocclusion. The lower right first molar was previously subjected to endodontic treatment with a post and a porcelain-fused-to-metal (PFM) crown.

Received 13 October 2021; revised 17 February 2022; accepted 13 April 2022.
Available online 17 June 2022.

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<https://doi.org/10.38209/2708-2636.1122>

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The upper and lower dental arches were in a square arch form. There was a space deficiency of 3 mm in the upper arch and 5 mm in the lower arch.

The cephalometric analysis showed that maxilla was retrognathism (Figure 2) with SNA angle of 78° . Skeletal Class III was also shown with an ANB angle



Figure 1. Pre-treatment facial photographs revealed straight to concave profile and occlusal plane canting. Pre-treatment intraoral photos showed bilateral Class III molar relationship and moderate crowding in lower arch.

of -1° and the Wits value was -8 mm. The lower incisors were retroclined (L1-NB 15°) and the incisor mandibular plane angle (IMPA) was 87° (Table 1).

Diagnosis

From the above data analysis, the patient was diagnosed as skeletal Class III with retrognathic maxilla and mildly deviated mandible, and Angle Class III molar malocclusion.

Treatment objectives

According to the examination, the treatment objective was mainly to relieve the crowding lower anterior teeth. The mandibular posterior teeth needed to be distalized to allow the anterior teeth to move to a proper dental arch position. Thus it also retract the anterior teeth to achieve an esthetic and harmonious profile. The occlusal plane canting was not planned to correct during the treatment.

Treatment plan

After discussing with the patient and her parents, the treatment plan was as follows:

- (1) tooth extraction of 18, 28, 38, 48;
- (2) distalization of mandibular dentition with TADs
- (3) harmonized facial profile and smile arch

Treatment progress

The extraction of the third molars was performed before treatment. A fixed appliance with 0.022×0.028 -inch slot pre-adjusted OPA-K bracket system was placed. Both arches were leveled with continuous wires, starting with 0.014 -inch nickel-titanium and worked up to 0.018×0.025 -inch stainless steel over the course of 8 months. Two mini-screws (AbsoAnchor Co.) were placed in the mandibular buccal shelf area. The two elastomeric chains exerting 250 gm were attached to the hook between the mandibular canine and first premolar in order to distalize the mandibular arch (Figure 3). The distalization of the mandibular dentition was completed via TADs after 10 months. Both mandibular first molars were moved 2 mm distally. In addition, Interproximal Reduction (IPR) was used to create a 2 mm space in the lower anterior teeth to reduce the dark triangle. A 0.019×0.025 -inch stainless steel arch-wire was placed for detailing and finishing. The total treatment period was two years and four months. Maxillary and mandibular wrap-around retainers were delivered for retention.

Treatment results

Angle Class I molar and canine relationship with an esthetic profile were achieved (Figure 4). All the third molars were extracted and the distance between lips and E-line were maintained (Figure 5). Cephalometric superimposition analysis showed that the upper incisors were advanced 1 mm and the inclination of lower anterior incisors was improved by 9° (L1-NB, from 15° to 24°). The interincisal angle decreased by 3° (from 132° to 129°) (Table 1). The distances of upper and lower lips to the E line were corrected near the normal values (Table 2). The distal movement of the mandibular first molars were 2 mm (Figure 6). The patient was satisfied with the esthetics of the facial profile (Figure 6).

DISCUSSION

Extraction versus non-extraction treatment planning in orthodontics had been controversial for the past century. Those who had bias against the extraction method may have been misled by the information that it might cause temporomandibular disorder (TMD). However, there were no obvious evidence to demonstrate that orthodontic extraction could induces TMD in the previous report.⁵

Nevertheless, it is important to consider other factors for extraction decision especially in Class III borderline patients. The major concern is the patient's soft tissue profile.³ Extraction of teeth leads to a flattened or concave profile in cases that have skeletal Class III relationship. Compared to dish-faced facial profile, a fuller outline is much preferred and well accepted. Extraction also has an impact on the esthetics of the buccal corridors. The maxillary premolar extraction may lead to the narrowing of the dental arch, causing dark buccal corridors. Inter-arch stability can be also taken into account when determining the treatment plan. Tweed concluded that the mandibular incisors should be in the range of 85° – 95° to achieve stability.⁴ In our Class III case, the retroclined lower incisors were corrected to 93° with mild proclination. By uprighting the lower incisors, we enhance the stability of the treatment.

For the non-extraction orthodontic treatment method, the orthodontist could consider applying the following five techniques to resolve dentition alignment problems. The first technique is to replacing bands with bracket bonding. Cemented molar band can reduce the chance of emergency visit and improve patient experience but the placement of the band requires the creation of interproximal space to accommodate the width of the

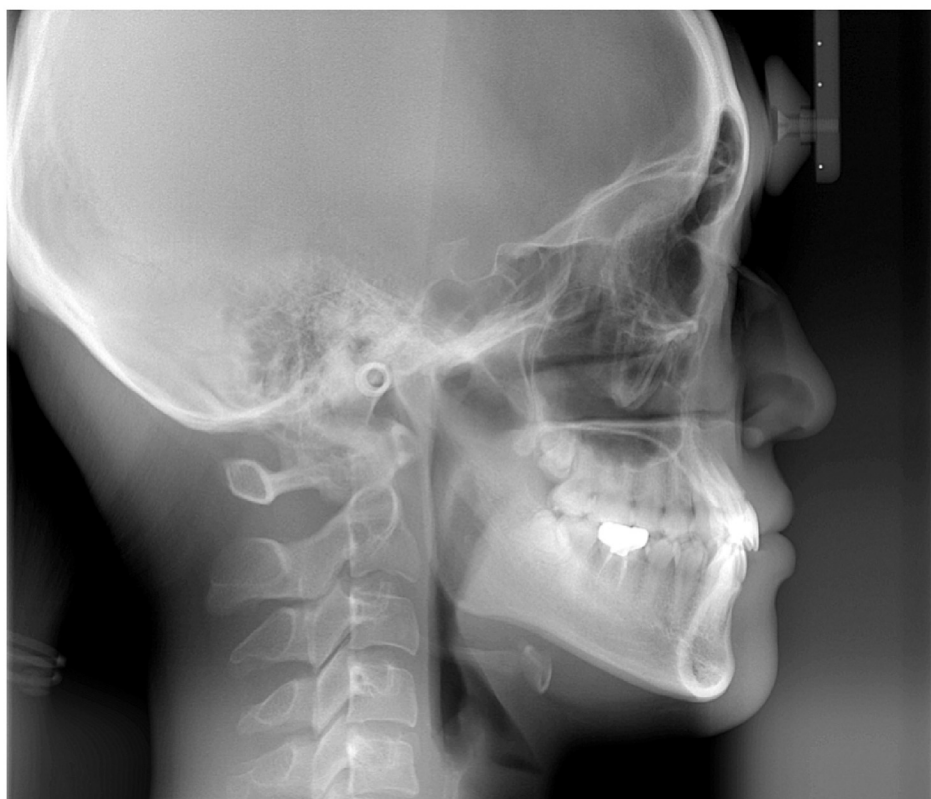


Figure 2. Initial radiographic films before treatment.

Table 1. Summary of cephalometric analysis (skeletal and dental).

Skeletal	Norm	Initial	Final
SNA (°)	79.8–83.2	78	78
SNB (°)	75.7–78.7	79	79
ANB (°)	3.2–5.0	–1	–1
Nv-A (mm)	0.0 ± 2.0	–2.0	–1.0
Nv-Pog (mm)	–5.0 ± 8.0	0	–1.0
FMA (°)	26–31	23	23
Wits (mm)	–1.0 ± 1.0	–8.0	–8.0
Dental	Norm	Initial	Final
U1-SN (°)	103.9–108.8	103	101
U1-NA (mm)	4.3–8.1	7.0	8.0
U1-NA (°)	22.8 ± 5.7	27.5	24
U1-L1 (°)	119.9 ± 8.5	136	129
L1-NB (mm)	5.4–10.2	4.0	6.0
L1-NB (°)	19.3–31.3	15	24
IMPA (°)	94 ± 6	87	93

band material of about 0.15 mm,⁶ whereas the bonding technique does not require this space.

The second technique is IPR to gain the space for adjusting the Bolton Index discrepancy. By IPR, 6–8 mm of the space can be gained to relieve protrusion, crowding, or a combination of both. Reduction of the interproximal surfaces is a common practice in both fixed appliance and clear aligner treatments. Zachrisson stated that reshaping

the anterior teeth morphology is a practical approach that is used to eliminate gingival recession (black triangle).⁷ In this case, IPR was applied on the lower anterior teeth to reduce the black triangles and to create space for anterior dentition retraction.

A thickness of only 0.5 mm of enamel is recommended to be removed at each interproximal surface.⁸ It is suggested that the removal of more than 0.3 mm of the upper incisors, 0.6 mm of the upper posterior teeth, 0.2 mm from the lower incisors and 0.6 mm from the mesial surface of posterior teeth should be avoided.⁹ One side effect of IPR is the frictional heat generated by the rotary instruments. Temperature increase of more than 5.5 °C in pulp may cause irreversible pulp changes.¹⁰ Constant water irrigation and air cooling can reduce the side effects of thermal changes. Topical fluoride application after IPR is suggested for tooth remineralization.¹¹ Zachrisson suggested that a twice-daily mouth rinsing with weak fluoride solution can be used to prevent tooth sensitivity.¹²

The third technique is the dental arch transverse expansion to gain more space to relieve the problem of crowding. The correction of transverse discrepancies is one of the methods for gaining space. Ricketts et al. stated that every 1 mm added to the

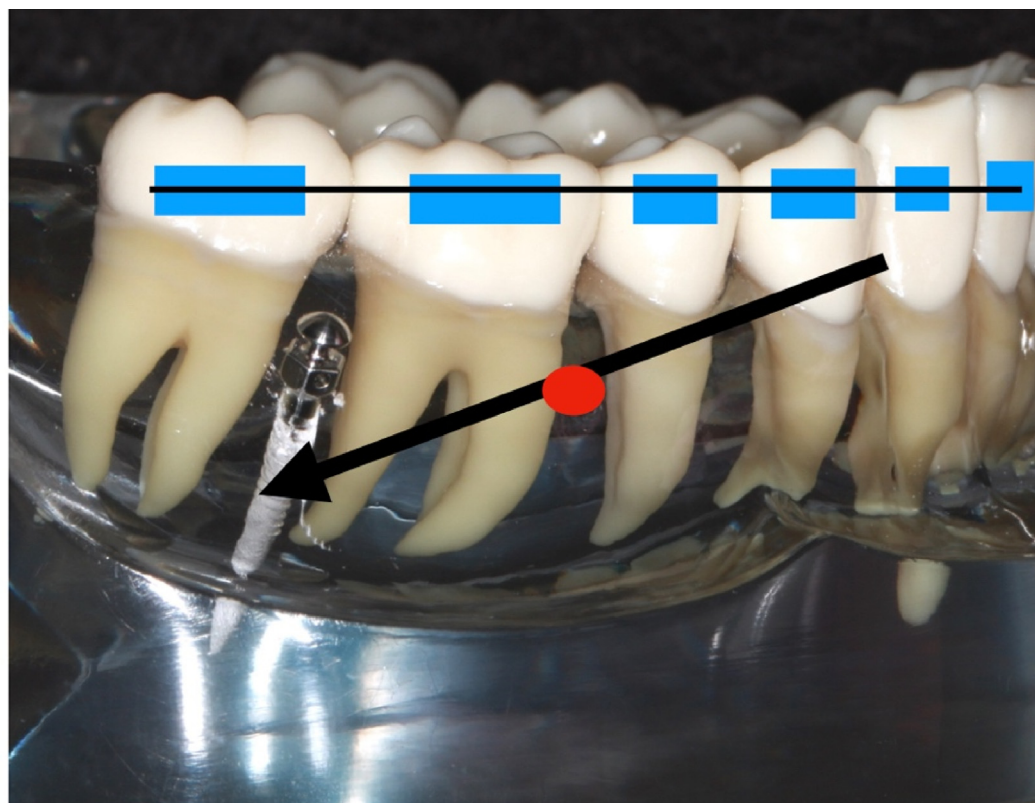


Figure 3. At the force angulation of -23° degree. The line action of the force (black line) passes through the center of resistance (red point).¹⁵



Figure 4. Post-treatment intraoral photos showed that the previous crowding and molar Class III relationship had been corrected.

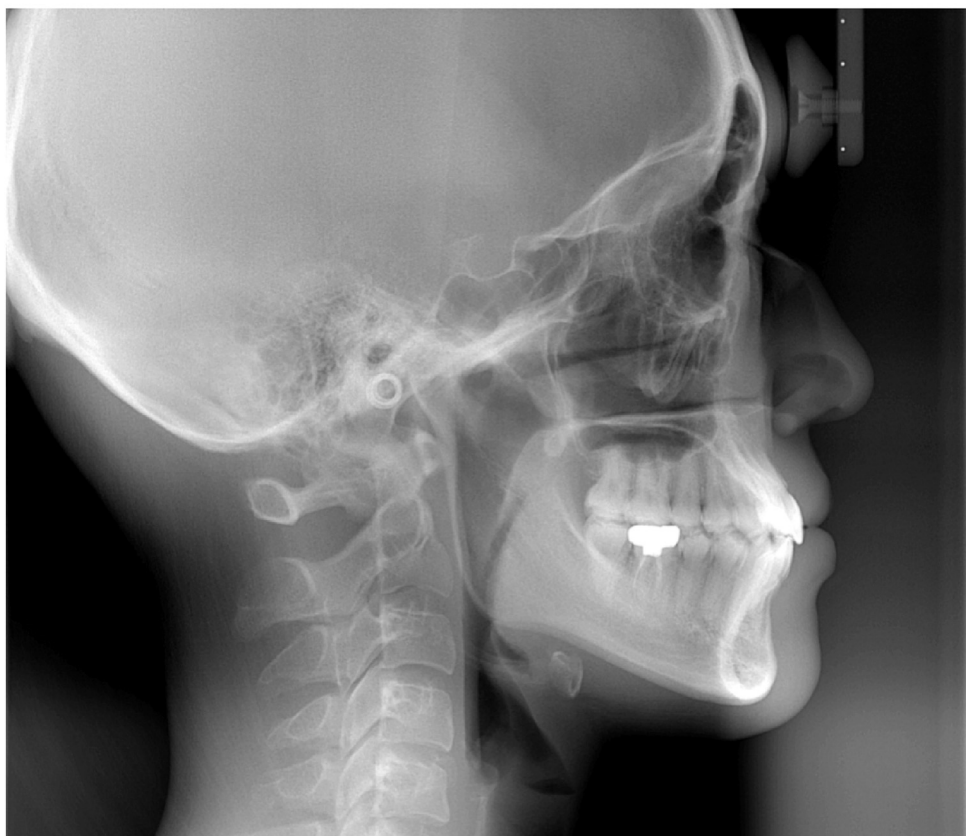
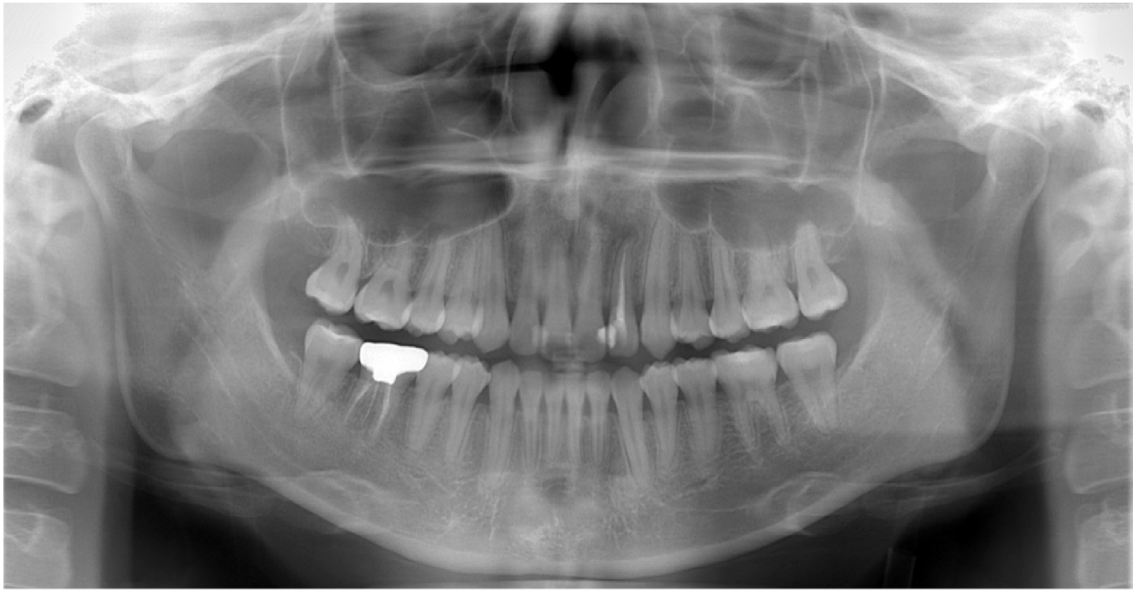


Figure 5. Post-treatment radiographic films.

Table 2. Summary of cephalometric analysis (soft tissue).

Soft tissue	Norm	Initial	Final
UL-E line (mm)	0.7–3.1	–3.0	–3.0
LL-E line (mm)	0.2–3.4	0	0

inter-molar width can increase the perimeter by 0.25 mm.¹³ Gandini also stated that a molar expansion of 1 mm increases the arch perimeter by 0.88 mm.¹⁴ Due to the cortical plate and the amount of attached gingiva, mandibular teeth should not be expanded more than 2–3 mm in the molar region. In addition, inter-canine over-expansion is unstable for gaining dentition space. Moreover, overexpansion may increase the risk for

gingival recession which should be monitored carefully.

The fourth technique is to use passive type self-ligating brackets (PTSLFs). Researches showed that PTSLFs are as beneficial as conventional brackets by reducing chairside time and controlling the mandibular incisor proclination.¹⁵ The leveling of curve of Spee increases the dental arch length with minor transverse expansion, which increased the space for the problem of crowding relief.

The fifth technique is the use of TADs to control distal molar distalization. The TAD application is a powerful tool that is used for treating malocclusions requiring molar distalization. The infrazygomatic

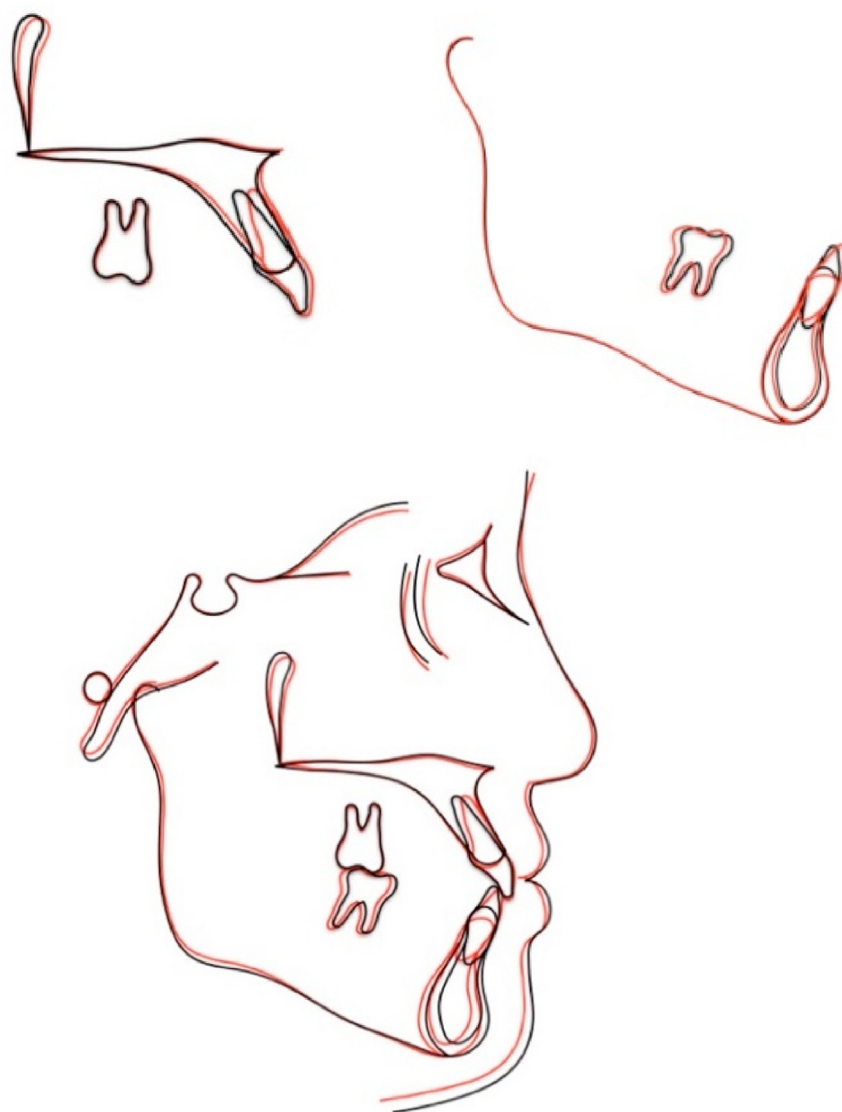


Figure 6. Pre-treatment (black line) and post-treatment (red line) superimpositions revealed that the profile was maintained. The upper incisors were advanced 1 mm and the lower anterior incisors were proclined by 9° (LI-NB, from 15° to 24°). The maxillary first molars were maintained and the distal movement of the mandibular first molars were 2 mm.

region and external oblique ridge are the best insertion sites of TAD for achieving dentition distalization. Third molars might affect distalization, therefore extraction before starting the procedure is recommended. In our case, the mandibular third molars were extracted before the distal movement activation. Due to the biomechanical forces of TAD on the mandible, the anterior dentition may tip lingually. To prevent this side effect, a reverse curve of Spee on the main wire or TADs with a force angulation of -23° to the occlusal plane should be applied to counteract the unwanted force.¹⁶ Another side effect is the increased force angulation to the occlusal plane causing a counter-clockwise rotation of the mandibular teeth. Another option that can be considered is the distalization of mandibular dentition with maxillary TADs and interarch elastics. If distalization of both arches is the treatment goal, this method can reduce the numbers of TADs required for anchorage, by eliminating the use of four TADs in the posterior region to two. However, there are two disadvantages to this technique. The first is that this technique relies strongly on patient's compliance which can be unpredictable. The second disadvantage is that the force would extrude the anterior teeth and cause the counterclockwise rotation of the lower arch. In this case report, the total arch distalization was achieved without occlusal plane alteration by using rigid archwires, and ensuring the force from TADs in the buccal shelf passed through the center of resistance of mandibular dentition.

According to research, the amount of molar distalization varied. The mean maxillary molar distalization with a mini-screw supported appliance value varied from 1.8 mm to 6.4 mm.¹⁷ In the mandible, the average amount of mandibular first molar distalization was 3.5 mm at the crown level and 1.8 mm at the root level.¹⁸ In our patient, the mandibular molars distalized by 2 mm using TADs, which was a satisfactory outcome.

CONCLUSION

The non-extraction treatment method was selected based on the patient's profile, occlusion, and their chief complaint. This case report showed the successfully corrected molar relationship and arch crowding with the use of TADs for molar distalization and IPR. A pleasing esthetic outcome and stable occlusion were achieved.

FUNDING

None.

ETHICAL APPROVAL

Not required.

PATIENT CONSENT

Provided.

CONFLICTS OF INTEREST STATEMENT

The authors declare no conflicts of interest.

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